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BULLETIN  
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Contributions to American Bryology—VI.

BY ELIZABETH G. BRITTON.

I. WESTERN SPECIES OF ORTHOTRICHUM.

In a recent letter Dr. Venturi says that "there is great confusion in the genus *Orthotrichum*, due to the fact that American authors have described many new species, and that European authors have described others without taking into account what had already been done in America."

Even a superficial survey of the field will convince us that this is only too true; but we think European bryologists are more accountable for this than American ones, for Sullivant at least, who described most of our new species, figured and gave complete characterizations of all which he proposed.

Since 1887 there have been added 14 species and 8 varieties of this genus to the flora of our Western States; 9 of these are new, and 5 others are previously described European ones. There were 5 new species added by Mitten in 1865, which were but little known and several not since collected, and in 1874 Sullivant figured and described 8 more. With the recent additions in the *Botanisches Centralblatt*, and *Hedwigia*, by Venturi; and Kindberg's and Müller's from Macoun's Canadian mosses, with a few of Renauld and Cardot's from Henderson's Oregon collections, it brings the number up to 47, many of which have been collected only once, and are still lacking in figures and parts of descriptions. It seemed desirable, therefore, to call the attention of students and

collectors in our Western States to this fact; to give in each case the exact localities where the types were collected, and to solicit more material, in order to enable us to arrive at some satisfactory conclusion in the future. To facilitate the better understanding of these species, they have been divided into groups, 5 with superficial stomata and 7 with immersed. Some of the species are referred with some doubt to these groups, and will probably have to be transferred when better understood. We have to thank Dr. Venturi for his valuable assistance, and M. J. Cardot and Prof. Macoun for the receipt of portions of types from their herbaria.

SECTION A. Those with superficial stomata.

I. GROUP OF *ORTHOTRICHUM RUPESTRE*.

This is entirely a Western group, none of the members of it having been collected east of the Rocky Mountains and Texas. To this group belong five species and several varieties, enumerated below. Rock species with short immersed capsules, with 8 distinct ridges, 16 erect teeth and 8 cilia. Calyptra hairy.

1. *ORTHOTRICHUM RUPESTRE* Schleich. Crypt. Helv. Ex. No. 24 (1806).

This species needs further study. Mr. Leiberg says that he meets with very puzzling variations, and his collections show a great diversity of forms, all within certain well-defined limits, however. As there have been five European varieties described by Venturi, only one of which is reported as American, it would seem as if critical work on this species would repay study. A recent paper in the *Revue Bryologique*, 58 (1893), states that this species, as well as *O. Sturmii* in Europe, has a preperistome as in the other group of rock species with immersed stomata.

Type specimen European. American specimens so named are distributed from the Rocky Mountains west to the Pacific Coast. Reported from California, Oregon, Nevada, Idaho and Colorado.

2. *ORTHOTRICHUM STURMII* Hoppe and Hornsch. Regensb. Flora, 89 (1819). Sull. Mosses U. S. 33 (1856), L. & J. Man. 166 (1884).

This species is very close to the above, and is separable from it only by its denser bistromatic leaves and the abrupt base of the

capsules. Venturi considers it scarcely distinct enough to be a species.

Type European. It has been reported from California, Nevada, Oregon, Colorado, through the Rocky Mountains north to British Columbia; also in Texas and New Mexico, collected by Wright.

3. ORTHOTRICHUM SHAWII Wilson; Br. & Sch. Br. Eu. Supp. fasc. 1-2 (1864). Philibert, Rev. Bryol. 9: 9 (1882).

Differs from the first two species by having no cilia, and the capsules are only faintly striate above and below when old.

Type rare; has only been collected in one locality in England. We have specimens collected by Bolander, which have been submitted to Venturi and referred to this species with some doubt from the description in Braithwaite's British Mosses.

4. ORTHOTRICHUM BOLANDERI Sull. Icon. Suppl. 64, t. 46 (1874).

Sullivant says that this is a very distinct species related to *O. rupestre* and *O. Sturmii*, but differing in the markings of the teeth, the longer, cylindric capsule and the bistromatic cells of the leaves. In February, 1890, Dr. Watson sent me a portion of this type. It is remarkable for its dense black stems and closely appressed and crowded leaves. We also have specimens from the Department of Agriculture, received November, 1890, from Bolander's duplicates, which agree with the types of this species.

The figures in Sullivant's Icones represent the capsules longer and more cylindric than the types. The capsules are not more than a third longer than broad, 1.5 by 1 mm., and less exerted than figured, and the teeth are more papillose than the cilia with more trabeculate joints.

They were compared with Mougeot and Nestler's *O. rupestre* in the Jaeger Herbarium "e manu Schimper," and I find the markings of the teeth are quite distinct, as Sullivant stated. If the European species is as variable as Dr. Venturi states, having the teeth either striolate or papillose, these might be included in that species, but with modern splitting tendencies, I think this species will stand.

Venturi classes it as *O. rupestre* var. *vulgare* (Musc. Gall. 156, 1887).

Type locality "Oakland Hills, on boulders," California, Bolander, October, 1868. Not since reported.

5. ORTHOTRICHUM TEXANUM Sull. Mosses U. S. 33 (1856). Icon. Musc. 53, t. 34 (1864).

According to Sullivant l. c. this species "differs from *O. Sturmii* in the larger size of the plants, longer, more acuminate leaves and double peristome."

Type locality, "Texas, Wright; Santa Fé, New Mexico, Fendler." Also California, Bolander, north to Vancouver, and British Columbia, east to Idaho and Colorado.

Var. *globosum* Lesq. Mem. Cal. Acad. 1: 17 (1868).

We have a fragment of this variety from the type specimen, and have examined the capsules. They are short, immersed or only partly exserted, globose pyriform, with a tapering neck, peristome single, teeth pale, smooth or with faint traces of thickening ridges as in *O. bullatum*, but not papillose. The spores are small, .016-.018 mm., warty and brown and the calyptra sparsely hairy. Our capsules are too young to show the ridges of the walls, the cells being still full of chlorophyll, though the spores are ripe. It would seem as if the thickening of the teeth and the ridges of the capsules were a later development.

Type locality, "Nevada Falls, Yosemite, California, Bolander." Also reported in Macoun's Catalogue from Agassiz and Yale, British Columbia; specimens not seen.

6. ORTHOTRICHUM DOUGLASHI Duby, Mem. Soc. Phys. d'Hist. Nat. Geneva (1868), Bull. Torr. Bot. Club, 20: 400 (1893).

This species has already been described from the types in a recent number of the BULLETIN. The type is immature, though sufficiently developed to refer specimens to it.

Type locality, Columbia River, Douglas; Idaho, Sandberg and Leiberger.

7. ORTHOTRICHUM BULLATUM CM. Flora, 70: 223 (1887).

Type locality, Napa Soda Springs, California, May, 1886, Martha R. Mann. A portion of the type specimen was sent me by Miss Clara E. Cummings, in January, 1891, with a copy of the original description. They agree, but the stomata are not mentioned. They are superficial around the middle of the capsules; nor the spores, which are rough with warts, and .013-.018 mm.; the cells around the mouth are densely thickened, with a projecting annulus; the teeth are slender and thickened with coarse sinuous ridges, and the plants are 5 cm. high and very

slender and flexuose. They are what we have been calling *O. Texanum*, without any inner cilia. Specimens collected by J. B. Leiberger, No. 134, sent to Dr. Venturi, were named by him *O. rupestre*. They seem to be the form figured in the Bryologia Europæa t. 217 as var.  $\gamma$ . *U. Sehlmeiyeri* Hornsch. None of the European specimens in the Jaeger herbarium are as slender or branching, all are more rigid, and I am inclined to think they show the same divergence from *O. rupestre* that *O. papillosum* does from *O. Lyellii*.

It will be remembered that in the Icones, Sullivan figured *O. Texanum* without cilia, but in the description he says they are present, but more or less rudimentary. It will also be remembered that the localities cited in the mosses of the United States are Texas, Wright; Santa Fe, New Mexico, Fendler, and that later in the Icones he added California, Bolander. The specimens distributed as No. 187 of S. & L. Musci, Bor. Am. Ed. 2, are from Texas. They are rather unsatisfactory, and I find them just as imperfect both in Prof. Eaton's set and in Sullivan's herbarium at Cambridge, but the description calls for tall lax specimens like these of Miss Mann's.

## II. GROUP OF ORTHOTRICHUM SPECIOSUM.

This group includes those species of the genus which have long, cylindric, exserted capsules with very faint ridges or entirely smooth. The teeth in pairs, reflexed or recurved when dry, and the cilia 8, erect. Six species and 5 varieties are here included: *O. speciosum*, *O. elegans*, *O. Killiasii*, *O. lævigatum*, *O. Kingianum* and *O. rhabdophorum*. *O. Rauei* and *O. Hainesiae* have been described by Austin, but reduced by subsequent authors.

### 8. ORTHOTRICHUM SPECIOSUM Nees.

This species occurs in the Eastern States from New Jersey to New Hampshire, is very common in Ontario, Quebec and the Eastern Canadian provinces, extending west to Vancouver Island. Type European.

Var. *polyanthum*, Lesqx. Mem. Cal. Acad. Sci. 1: 17 (1868).

On rocks, big trees, California, Bolander.

Var. *brevicaule*, Lesqx. Mem. Cal. Acad. Sci. 1: 17 (1868). "Same locality as the former."

Var. *Raueri* (Aust.) L. & J. Man. 169 (1884).

*Orthotrichum Raueri* Aust. Bull. Torr. Bot. Club, 6: 343 (1879).

Austin's types have been examined and compared with\* *O. speciosum*. There scarcely seems any necessity for maintaining this as distinct from var. *polycarpum*; though it antedates the latter. The capsules are numerous, long exserted, and striate at base and apex.

Type locality, Colorado, Brandegees, ex. herb. E. A. Rau.

Var. *polycarpum* L. & J. Man. 169 (1884).

Same locality as var. *Raueri*.

Var. *Roellii* Vent. Bot. Centr. 44: 419 (1890). Hedwigia, 32: 285 (1893).

Plants densely pulvinate, dark green; leaves almost smooth papillæ very minute, cells large, margins revolute; capsule emergent, oblong ovate, smooth, peristome normal.

Argyle, near Chicago, Illinois. Röhl.

8a. *Orthotrichum Hainesiae* Aust. Bull. Torr. Bot. Club, 6: 342 (1879).

We have examined Austin's type and have compared it with *O. speciosum*, to which it was referred as a form in the Manual. It agrees with that species microscopically, but the plants are dark, depauperate specimens, with spreading leaves, and almost smooth calyptras, and differ in aspect from No. 186 S. & L. Musci Bor. Am. Ed. 2, having the capsules smaller and more immersed. Both plants are from the Rocky Mountains, and grew on rocks.

9. *ORTHOTRICHUM ELEGANS* Schwaegr.

Differs from *O. speciosum* only in the teeth being reflexed, not revolute when dry, and in the less papillose leaves.

Pend Oreille River, and between that and Kootenay River, British Columbia, Lyall. Also collected by J. B. Leiberger on ledges at Lake Pend d'Oreille, Idaho, May, 1889, No. 9 and 152 in part.

10. *ORTHOTRICHUM KILLIASII* C. M. Bot. Zeit. 4 (1859).

Venturi considers this only an Alpine variety of *O. speciosum*, differing in its smaller size, denser cushions and shorter leaves.

Growing on rocks in alpine regions. Reported from Disco Island.

## 11. ORTHOTRICHUM LÆVIGATUM Zett.

Venturi classed this species in the group with *O. rupestre*, in the *Muscologia Gallica*, but in a recent number of *Hedwigia* he says that he finds the teeth when dry reflexed as in *O. speciosum*, with which group it is more closely allied by its long cylindric capsule exserted and smooth, or the ridges very short and faint, the teeth united in pairs, and the cilia 8. He states that while it is very rare in Northern Europe, in America it is common, having been collected in many localities by Dr. Röhl, and showing several forms. (*Hedwigia*, 32: 227, 1893).

It has been collected in the Rocky Mountains, from Nevada, Idaho, Oregon, Washington, to British Columbia.

12. ORTHOTRICHUM RHABDOPHORUM Vent. Bot. Cent. 8 (1890); *Hedwigia*, 32: 283 (1893).

It is said to differ from *O. lævigatum* by the ridges being continuous the entire length of the old capsules, while they are fainter in the operculate stage, and the cilia more or less perfect.

Type from Cascades, Thorp, Washington, Röhl.

## 13. ORTHOTRICHUM KINGIANUM Lesqx. Mem. Cal. Acad 1: 18 (1868); Sull. Icon. Suppl. 74, t. 55 (1874); Bull. Torr. Bot. Club, 20: 401 (1893).

Since I have seen the types of Dr. Venturi's group of *Orthotrichum stenocarpum*, and compared them with *O. Macounii*, I have found another portion of the type of *O. Kingianum* in Austin's herbarium with *O. Macounii*, and compared it with the species of this section. They have a seta 3-4 mm. long, twice the length of the capsule, and quite exserted with a long vaginule, and the neck tapering into the seta, which is twisted; the capsules are narrowly cylindric when empty, and the central cone of tissue remains as figured in the *Icones*, figs. 8-11. The teeth are erect, united in pairs as figured, with the segments and thickening ridges very indistinct and uncertain. The cilia, too, are not as clearly developed as the artist has figured them. In Sullivant's type the upper cells of the leaves are large, occasionally .018 mm. in length, with much thickened walls and short blunt papillæ; the lower cells are oblong, longer and smoother, and the basal angles auricled and brown. The vein is thick, deeply channeled, and brown, ending below the apex, the margins are strongly revolute, and the cells



appear to be inflated and protruding in the middle part of the leaf. In the light of later study this species seems to be more allied to the group of *O. Macounii* than to that of *O. lævigatum*, and may possibly antedate one of the recent new ones from the Pacific Coast.

Type locality, on rocks, Falls of the Yosemite, Bolander. Kindberg cites Macoun's numbers 240 and 289 as this species, but we have not seen the specimens. It is to be hoped any botanists visiting the Falls of the Yosemite will try to collect this species again.

### III. GROUP OF *O. MACOUNII*.

(Group of *O. stenocarpum* Vent. Hedwigia, 32: 271, 1893).

Dr. Venturi includes in this group three very closely allied species, *O. stenocarpum*, *O. Roellii* and *O. Schlotthaueri*, which he says form a new type of the genus and a connecting link between *Orthotrichum* and the species of *Ulota* with straight leaves, like *U. Hutchinsiae*, which they closely resemble in their habitat, dark green dense growth and long exserted capsules. The bell-shaped, entire calyptra differs from that of *Ulota*, however. He enters into a long discussion of generic differences and suggests other lines of classification for the species of these two genera based on the stomata, etc.

14. *ORTHOTRICHUM MACOUNII* Austin, Bull. Torr. Bot. Club, 6: 343 (1879). *Orthotrichum stenocarpum* Vent. Bot. Cent. 44: 389 (1890). Hedwigia 32: 221 (1893), non Bridel Bryol. Univ. 274 (1826).

Austin's description was published five years before the Manual was issued and listed in Rau and Hervey's Catalogue in 1880, yet it is not to be found in the Manual, nor in Barnes' Key nor in Renauld and Cardot's Catalogue. His species is a good one, represented by fine specimens, and compared critically with authentic specimens of its nearest ally at the time it was published, *O. Kingianum*, to which it is related by its superficial stomata, exserted cylindric capsule, perfectly smooth when dry, with a long tapering neck. The upper cells of the leaves also are large and bluntly papillose as in that species. The following are Austin's remarks on the two species.

"Closely related to *O. Kingianum* Sull., but compared with a specimen from James ex herb., Lesqx., it differs as follows: More robust, leaves less erect, longer, less densely papillose, with the upper cells larger and less granulose, the lower ones much less enlarged and in the older leaves not at all pellucid; capsule paler, narrower, exactly cylindrical when moist, etc. Compared with the description and figures in *Icones Suppl.* p. 74, t. 55, the leaves are much more acute and of a uniform texture throughout, costa extending nearer the apex; capsule not obovate when moist, the mouth not broader when dry, teeth granulose, straw-colored, not brown."

Through the kindness of Dr. Venturi I have a portion of the type of *O. stenocarpum*. We also have Röll's Number 606 from Roslyn, Washington, and four specimens collected by J. B. Leiberger on granite ledges at Lake Pend d'Oreille, and Rathdrum, which have been named by Dr. Venturi. We have no hesitation in saying that Austin's species antedates Dr. Venturi's, and this latter is doubly debarred by Bridel's name of 1826, of which it is a homonym.

Type locality on rocks, Cascades, British Columbia, Macoun, May 17th, 1875. Also collected by Röll on rocks near Easton, Washington, No. 604; near Rigi, Clear Lake, Washington, 900; Roslyn, 606; Ellensburg, Thorp, 607, and by J. B. Leiberger near Lake Pend d'Oreille and Rathdrum, Idaho, 1888, Nos. 8 and 11 and 11a.

15. ORTHOTICHUM ROELLII Vent. Bot. Cent. 44: 416 (1890), Hedwigia, 32: 216, 222 (1893). *O. lonchothecium* CM. & Kindb. Macoun's Cat. 6, 90 (1892).

There seems to be some doubt to which species Kindberg's should be referred. In his letters Dr. Venturi has said it was the same as *O. stenocarpum*, but in Ren. & Cardot's list it is cited as a synonym of *O. Roellii*. (Rev. Bryol. 19: 19, 1892.)

This species has also exerted cylindric capsules with short ridges, erect, striolate not papillose teeth, united in pairs, with a few vestiges of cilia.

Type from rocks at Thorp, near Ellensburg, Washington, Röll. The localities cited in Macoun's Catalogue for *O. lonchothecium* are both "on trees," Krao Creek, Kootenai Lake, B. C., and at Banff, Rocky Mts., Macoun; though the specimens distributed as No. 497 of Macoun's Canadian mosses labelled *O. lonchothecium* are from "metamorphic rocks" at Deer Park, Lower Arrow Lake, B. C., June 4th, 1890.

16. ORTHOTRICHUM SCHLOTTHAUERI Vent. Bot. Cent. **44**: 416 (1890). Hedwigia, **32**: 216, 223 (1893). Rev. Bryol. **19**: 18 (1892).

This species has exserted cylindric capsules not sulcate, teeth erect, united in pairs, but split nearly to base, papillose; cilia more or less fugacious or deficient.

Type from the Rocky Mountains at Garrison, Montana, Röhl, also collected in Sun River Cañon, Montana, by R. S. Williams, No. 97, named by Venturi.

#### IV. GROUP OF O. AFFINE.

17. ORTHOTRICHUM AFFINE Schrad. Spic. fl. Germ. 67 (1794). Bull. Torr. Bot. Club, **20**: 394 (1893).

This species occurs in the Eastern States, around the Great Lakes, and in the Northeastern provinces of Canada.

Var. *neglectum* (Schimp.) Vent. Musc. Gall. 171 (1887). Specimens collected by J. B. Leiberger at Lake Pend d'Oreille on trees, No. 88, have recently been determined by Dr. Venturi as this variety. It has not been previously reported from North America.

#### V. GROUP OF O. LYELLII.

In a recent number of the BULLETIN (**20**: 397, 1893) we expressed our views on this group. Dr. Venturi's remarks in Hedwigia, **32**: 273, 286 (1893) will be found interesting. We have another synonym to add to the ones already enumerated for this species, *O. Menziesii* Mitt. (Journ. Linn. Soc. **8**: 25, 1865).

#### VI. GROUP OF O. ARCTICUM.

Five species in this group are known to occur in Greenland, and probably in Arctic America. They are characterized by a short pyriform capsule, exserted on a short seta; teeth reflexed in pairs, cilia 8, short triangular or rudimentary. None of the group had been reported from the United States, until Dr. Venturi recently described one.

18. ORTHOTRICHUM PRÆMORSUM Vent. Bot. Cent. **44**: 418 (1890). Hedwigia, **32**: 269, 282 (1893).

Said to be closely allied to *O. Caucasicum* Vent. (Musc. Gall. 176, t. 48, 1887). Characterized by its hygroscopic leaves and non-arctic habitat.

Type locality, Yellowstone National Park, Wyoming, Röhl.

SECTION B. Those with immersed stomata.

\**Brachytrichum*. Capsules with 8–16 striæ, and a more or less developed preperistome.

#### I. GROUP OF *O. CUPULATUM*.

Capsules immersed or more or less exserted. Rock species, rarely on trees.

This group has been discussed at length in two previous communications (Bull. Torr. Bot. Club, 20: 401–404 and 21: 1–4). It includes 3 species with exserted capsules, *O. anomalum*, *O. saxatile* and *O. nudum*, and four with immersed, *O. cupulatum*, *O. urnigerum*, *O. Porteri* and *O. Lescurii*, of which the two latter have only been found in the Eastern States. Two poorly characterized varieties of *O. anomalum* have been recently added.

#### 19. *ORTHOTRICHUM ANOMALUM*.

Type European. Occurs in the Eastern States from Pennsylvania to Ontario and the Canadian provinces, west to the Rocky Mountains. Not yet reported from the Pacific slope.

Var. *Americanum* Vent. Macoun's Cat. part 6: 86 (1892).

Type localities. Distributed in Drummond's Mosses, No. 148. "Hab. upon rocks common," and in Macoun's Canadian Mosses No. 118 in part, on rocks along the shore of Lake Winnepegosis, Manitoba and on boulders and sandstone rocks, Hand Hills, Alberta, Macoun.

This is very insufficiently described as "a form that has yellow capsules and differs considerably from the normal one in the well-evolute cilia." I asked Dr. Venturi if it could be referred to *Orthotrichum saxatile* (Lipr.), but he says this is only a variety or even a form of *O. anomalum*, and is not the same as var. *Americanum*. "The characters indicated by Limpricht are not tenable. The size of the capsules and the leaves is relative, and the number of ridges on the capsule is variable. I have seen one side of a capsule with intermediate ridges and the other without them."

We have compared Drummond's No. 148 with No. 181 of Rabenhorst's *Bryotheca Europæa*, cited by Limpricht in his *Laubmoose* under *O. anomalum*, and with specimens of this species sent to Dr. Torrey by Greville, from Scotland. We cannot find any

constant differences. The leaves are identical, so is the size of the capsules and length of the setæ. The striæ are known to be variable. They are more prominent in Greville's specimen than in Drummond's, and less so in No. 181. The preperistome is hard to see in all three. We are not sure that we distinguished it. The base of the teeth appears more roughly papillose and less striate; there were no cilia present.

We asked Dr. Venturi to tell us what he considered the main difference in var. *Americanum*, and he replied (Nov. 30th, 1893) that he cannot find a scrap of it nor a drawing of the peristome, and does not remember giving the varietal name, and therefore cannot give us the information required. We have been favored with specimens by Prof. Macoun of his No. 872a, from Lake Winnepegoosis, July 6th, 1882, and three other specimens from Ontario and Saskatchewan. The ones from Lake Winnepegoosis have the three or four lower joints of the teeth much thickened and yellow, with large conspicuous ridges; the preperistome is very distinct, and there are no cilia. There are 12 striæ on one capsule, that is the secondary ones were absent in four spaces.

Var. *Venturi* (Kindb).

*O. Venturi* Kindb. Mac. Cat. part 6: 87 (1892). Canad. Mosses, No. 455, non DeNot.

There is another contradiction here. The Catalogue says: "On cedar (*Thuja occidentalis*) rails, Simon Terrill's farm, Brighton, Ontario;" and the label of No. 455 reads: "On sandstone boulders, Belleville," Ontario." There is no description.

20. *ORTHOTRICHUM NUDUM* Dicks.

Type European. We have no American station for this species.

Var. *Rudolphianum* (Schimp.) Vent.

We note that Venturi maintains this as a variety, and Limpricht unites it with the species. Macoun's Catalogue cites the variety as collected by Drummond "on rocks near the Whirlpool, below Niagara Falls; also along Kootenai Lake, British Columbia." Dr. Venturi has recently determined specimens collected by R. S. Williams, No. 59, at Great Falls, Montana, and No. 185, collected by J. B. Leiberg, at Lake Pend d'Oreille, No. 185, on granite ledges, as this variety.

21. *ORTHOTRICHUM CUPULATUM*, Hoffm.

As we have already shown, this species is not definitely known from the Eastern States. We have three Western specimens so named: J. B. Leiberg's No. 304, from calcareous ledges, Lake Pend d'Oreille, Idaho; Macoun's, from Arrow Lake, British Columbia, on rocks; and Howell's, No. 10, from Steens Mountain, Oregon, May, 1885. Also recorded by Lesquereux, collected by Bolander. "On metamorphic limestone rocks, near the Russian River, Ukiah."

More material and study is required to learn the range of this species.

22. *ORTHOTRICHUM URNIGERUM*, Myrin. Coroll. Fl. Upsal. 71 (1834).

Type European. "On silicious rocks of mountainous regions in Switzerland and Norway, not common." (Musc. Gall. 163 1887).

This species has recently been reported by Dr. Venturi from Röll's Collection in Yellowstone National Park, Wyoming. It differs from the rest of the group in having no preperistome. It has 16 cilia and a hairy calyptra, and the capsules are immersed, with 16 striæ.

*\*\*Euorthotrichum.* Capsules with only 8 striæ and no preperistome. Usually tree species, rarely on rocks.

II. GROUP OF *O. DIAPHANUM*.23. *ORTHOTRICHUM DIAPHANUM* (Gmel.) Schrad.

Type European. Venturi says this species is quite common on trees and walls in Central Europe, more rare in the mountains and the North of Europe. Braithwaite says: "This little moss is easily overlooked, as it only grows in small tufts and somewhat sporadically; it may be recognized at once by its hyaline points to the leaves." It also has 16 cilia and a smooth calyptra.

It has been collected by Wright at San Marcos, Texas; and by Brandegee in Colorado (Bot. Gaz. 9: 151, 1884).

24. *ORTHOTRICHUM CANUM* Mitt. Journ. Linn. Soc. 8: 26 (1865).  
L. and J. Manual, 176 (1884).

Differs from the last species in the shorter hyaline point of the leaves, the hairy calyptra, and the cilia of two rows of cells.

Type locality, British America; Drummond, also reported with a ? from San Marcos, Texas, Wright. A note in Sullivant's herbarium states: "That the parcel with Wright's specimens has two forms, one referable by its foliage to *O. diaphanum*, the other appears to be *O. canum*, Mitten." It seems probable that all of Wright's Texan specimens are *O. diaphanum*, and that *O. canum* is too close to be a good species. That *O. diaphanum* is a variable species is shown by the three described varieties cited by Limpricht, one of which has a naked calyptra, and another sparsely hairy; the third is an aquatic form.

### III. GROUP OF *O. RIVULARE*.

Plants more or less aquatic, dark green. Leaves blunt, vein ending below the apex, capsule immersed, 8-ribbed, teeth united in pairs and reflexed when dry, cilia 16, calyptra smooth.

#### 25. *ORTHOTRICHUM RIVULARE* Turn.

Type European. Venturi says "it seems abundant in North America, where the upper leaves are more frequently denticulate at the point." It seems to be confined to the Pacific Slope, having been found only in California, Oregon and Washington (Suksdorf).

#### 26. *ORTHOTRICHUM SPRUCEI* Mont.

A very rare species, known from only a few stations in France and Belgium, besides the British localities.

It has recently been determined by Dr. Venturi as No. 208, collected by J. B. Leiberger "on Willows overhanging in the old Channel of Clark's Fork of the Columbia River, evidently submerged during high water. Only a few specimens found, September 14, 1889."

Philibert records a hybrid between *O. Sprucei* and *O. diaphanum*. (Rev. Bryol. 10: 8, 1883), also on periodically submerged willows near Bruailles, France.

#### 27. *ORTHOTRICHUM EURYPHYLLUM* Vent. Bot. Cent. 44: 417 (1890). Hedwigia 32: 268, 281 (1893).

Dr. Venturi remarks that this species may also possibly be a hybrid, as it unites the characters of two groups, having the leaf form and peculiar strong cilia of *O. rivulare*, and the form of the capsule and peristome of *O. cupulatum*.

Type locality, Cascades at Ellensburg, Washington, Röll. On stones by the river near Thorp.

#### IV. GROUP OF *O. PULCHELLUM*.

Dr. Venturi states, *Hedwigia*, 32: 275 (1893), that Dr. Röll collected more forms of this group than occur in Europe, and concludes from their examination that the color of the peristome is of little value, as he found on the same clump some capsules with colorless teeth and others with colored. The form of the leaf appears to be more constant, the margins being more revolute in American specimens than in European, and the leaves are generally longer and narrower, with the fruit scarcely rising above the perichaetial leaves. The specimens with broad and short leaves and seta 5 mm. long, with capsules larger and more exserted, he thinks are referable to *O. Columbicum* Mitt.

The group is characterized by an exserted capsule, faintly striate, the teeth united in pairs or parted to base, with 16 appendiculate cilia, united by a basal membrane, and the leaves faintly papillose. The following species are included, and two varieties have been described which need comparison with previously recognized ones. In fact the whole group is in need of revision, there being two of Mitten's species which are poorly understood.

#### 28. *ORTHOTRICHUM PULCHELLUM* Brunton.

Type locality, European; also reported as collected by E. Hall in Oregon, and by Harrington in Alaska.

Var. *longipes* Sull.

The description seems to agree with that of the European form known as *O. Winteri*, and agrees with the figures given by Venturi (*Musc. Gall. t. 52*), whereas the description of *O. Columbicum* agrees with that of the typical *O. pulchellum*. Locality not stated.

Var. *productipes* R. & C. *Bot. Gaz.* 15: 43 (1890).

Much more robust than the type, with larger leaves, a longer pedicel (4–6 mm.), and the teeth of the peristome larger and paler.

Oregon, on trees and shrubs, L. F. Henderson.

"Perhaps identical with var. *longipes* Sull., but the description of this last variety in the Manual 175 is too incomplete to allow a positive identification." It will be noted that Venturi includes this variety under *O. glabrum*.



Var. *leucodon* Vent. Bot. Cent. **44**: 419 (1890). Hedwigia, **32**: 285 (1893).

Differs in the paler color of the plants, capsules and peristome, and in the seta, 5 mm. long.

Type locality, Vancouver Island and Tacoma, Washington, Röhl.

29. ORTHOTRICHUM ULOTÆFORME R. & C. Bot. Gaz. **15**: 42, *t. 7b* (1890).

*Orthotrichum glabrum*, Vent. Hedw, **32**: 285 (1893).

Dr. Venturi states that specimens sent to him by Renault and Cardot as *Ulotā glabra* and *Orthotrichum productipes* are forms sufficiently distinct from *O. pulchellum* to rank as a species, and he adopts the first specific name, but transfers it to *Orthotrichum*. That is, he takes a manuscript name and rejects the printed name, for *Ulotā glabra* R. & C., m. s. is given an equivalent to *O. ulotæforme* by the authors. It is by the first name it must stand. Differs from *O. pulchellum* in the teeth united in pairs to apex, cilia 16, united at base, with a broader, more constant basal membrane. This species suggests a *Ulotā* by its somewhat curled leaves, long, exserted capsules, on a slender seta. But it has immersed stomata, and 16 cilia, with a smooth calyptra, and evidently belongs with the group of *O. pulchellum*.

Type locality, Coast Mountains, Oregon, Henderson, on bushes, also collected by Röhl at Weston, "Enumclaw," Washington.

30. ORTHOTRICHUM COLUMBICUM Mitt. Journ. Linn. Soc. **8**: 24 (1865).

This species has been referred as a variety to *O. pulchellum* by Sullivant, but in the light of modern ideas as to the specific values, it will have to be compared with recent new species to determine its value. Dr. Venturi states that he has a specimen shared with him by Lindberg which is named *O. Columbicum*, Mitt., which he supposed to be authentic, but which does not agree with the remarks in the Manual. The Manual states that *O. Columbicum*, Mitt., is according to Sullivant's note in his herbarium a variety with shorter perichætal leaves, the male flowers on short terminal branches, the capsule subexserted on a short pedicel, and the teeth and cilia 8. Sullivant probably saw the type, as he had all of

Mitten's American specimens here for several years before he died. They were not returned to Mitten till quite recently (1891) by Dr. Watson at my request. Mitten's original description does not throw any light on the points in question.

Type locality, "on trees Vancouver Island, Lyall."

31, *ORTHOTRICHUM CONSIMILE* Mitt. Journ. Linn. Soc. 8: 24 (1865).  
Sull. Icon. Suppl. 59 t. 43 (1874).

"Allied to *O. pulchellum*, differing especially in the shorter, broader capsule, teeth papillose, not vermicular, cilia 8, smooth, and in the uniformly papillose leaves." Sullivant's figures in the Supplement are presumably from the type.

Type locality, Vancouver Island, Lyall. The specimens distributed as No. 125 in Macoun's Canadian mosses, are listed in the Catalogue *O. pulchellum*. They are larger than the type, with longer pedicels and smooth calyptras. The teeth also are papillose on the outside, and striate inside, like those of *O. pulchellum*. The cilia are 16.

We have seen the type and have the following notes: Plants small, 5-7 mm. high, light yellow; leaves short, 1-2 mm. long. papillose, often more acuminate than figured by Sullivant, ending in a single cell, seta short 2 mm. capsule short 1-1.25 mm. elongated and striate when dry, splitting between the ridges when old, striæ strongly differentiated, of 4 rows of equal cells with thick walls, the spaces between them very thin; cells around the mouth small and round, annulus large, persistent; teeth pale, short incurved, when dry, the outer surface papillose, the inner striate, but as often transversely as perpendicularly, and less distinctly than in *O. pulchellum*; spores .010-.013 mm., rough, brown.

We have specimens from Marshall A. Howe, No. 74 collected on trees at Olema, Marin Co., California, January 11th, 1894, which agree pretty well with *O. consimile*, but are larger with longer capsules. Those collected by C. V. Piper on trees, Seattle, Washington, 4.10, 1891, and distributed as No. 104b, by Prof. Eaton in his *Musci Occidentali Americani* are evidently *O. pulchellum*, having longer setæ, and 16 cilia.

#### V. GROUP OF *O. PALLENS*.

In this group are included *O. pallens*, *O. Canadense*, *O. alpestre*, and *O. Watsoni*. They are characterized by the immersed or partially exserted capsules, tapering into the seta with a neck usually

as long as the sporesac, and more or less strangulate when dry. Leaves narrow, with the vein ending in the apex, teeth reflexed in pairs, cilia 8 or 16. Several of these species are poorly understood, or have been collected only once.

32. *ORTHOTRICHUM PALLENS* Bruch.

Leaves blunt, strongly papillose, calyptra naked, teeth united in pairs, reflexed when dry, cilia 16, alternately longer and shorter; stomata immersed but wide open, often showing the outlines of the guard cells.

Type European, grows on trees, especially on beeches, in the mountains of Europe, rarely on rocks. It has been credited to North America by Mitten, from specimens collected by Lyall, Pack River, British Columbia. (Journ. Linn. Soc. 8: 23, 1865.) Not since reported.

Var. *parvum* Hedw. (Hedwigia 12: 1873; 32: 284, 1893.)

Plants smaller, yellowish green, the capsules with neck and pedicel not reaching 2mm. in length.

Collected by Röhl in Yellowstone National Park, Wyoming.

33. *ORTHOTRICHUM CANADENSE* Br. and Sch.

We have already discussed at length the merits of this species. (Bull. Torr. Bot. Club, 21: 9, 1894).

Drummond's Nos. 149 and 151, from Upper Canada, have been referred to this species and the following one.

34. *ORTHOTRICHUM ALPESTRE* Hornsch.

Differs from *O. pallens* in having only 8 cilia and a hairy calyptra; the teeth are striate at apex. More closely related to *O. stramineum*, having been referred to it as a variety.

Type locality: European, on rocks in Alpine regions. Has been collected by R. S. Williams, Belt Mountains, Montana, No. 96.

35. *ORTHOTRICHUM OCCIDENTALE* James, Bot. King's Exp. 402 (1871).

Var. *majus* L. and J. Man. 169 (1884); Sull. Icon. Musc. Suppl. 69, t. 51 (1874).

As already remarked in the BULLETIN (21: 10, 1894), this variety is poorly understood, and is based on two specimens, one of which, Drummond's No. 149, was included in *O. Canadense* Br. and Sch., and Watson's specimens from Utah. The name given by James has priority over the varietal name in the Manual, for

Sullivant, although he figured it in the *Icones* t. 51, gave it no name.

36. *ORTHOTRICHUM WATSONI* James, Bot. U. S. Expl. Exp. 40th Par. 401 (1871); Sull. Icon. Suppl. 73, t. 54 (1874); L. and J. Man. 168 (1884).

This species has the densely papillose leaves with strongly revolute margins of *O. alpestre*. It also has sub-immersed capsules, which are urceolate when old, with a flaring mouth, and 8 striæ, the teeth united in pairs, and 8 cilia which are described as "robust, punctate." The calyptra is slightly hairy, but the teeth are described as smooth and figured without striations.

Dr. Venturi (Musc. Gall. 163, 1887) refers this species to the group of *O. cupulatum* near *O. urnigerum* var. *Schubertianum*, but says that the description is too brief, and the specimens in his collection do not permit of a decision as to its specific value.

Type locality: On damp rocks in shade, West Humboldt Mountains, Nevada, altitude 5,500 ft., S. Watson. We have the specimens which were collected in June, 1867, and distributed as No. 1402, with autograph label by T. P. James. The plants are 2 cm. tall, yellowish green with spreading leaves, 3 mm. long; the calyptra is brown and more hairy and less glossy than European specimens of *O. alpestre*, or than R. S. William's No. 96, with which they were compared. The Manual says the capsules are without a neck. This is not true, as the striæ of the capsule are continued down into a distinctly twisted neck. No. 1404, collected by Watson in the Pah Ute Mountains, Nevada, in August, also has a little of this species mixed with two others. It was collected at the same elevation, and was distributed as *O. lævigatum* Zett.

#### VI. GROUP OF *O. PUMILUM*.

In the Western States, as well as in the Eastern, this species and its allies is but little known, and in Europe they seem to be in the same condition, for Dr. Venturi writes that as understood by him and Grönwall, this species is more closely related to *O. Schimperii* (*fallax*), whereas Limpricht describes it as more nearly related to *O. pallens*, and Dr. Venturi goes so far as to say that he thinks Limpricht has described *O. pallens* var. *minus* as *O. pumilum*, in his Laubmoose, and that he intends to reëxamine all his European specimens, but does not hope to reach a satisfactory conclusion. If the type is accessible this should be possible.

37. *ORTHOTRICHUM PUMILUM* Sw. Disp. Musc. Suec. 42, 92, *t.* 4 (1799).

This species has an oblong cylindric capsule, half exserted, with a tapering neck and a short seta immersed in the ochrea. The capsules are 1.5 mm. long, occasionally shorter and ovoid, the neck half the length of the sporesac. The striæ are very prominent, teeth united in pairs, cilia 8 of two rows of cells.

Type Norwegian. Frequent on trees in Scandinavia and Northern Germany, rarer in the mountains of Central Europe. This species has recently been determined by Dr. Venturi from specimens in our herbarium, collected by R. S. Williams, No. 52. "On willows mouth of Sand Coulee, Montana, April 1, 1887."

38. *ORTHOTRICHUM HALLII* S. & L. Sull. Icon. Musc. Suppl. 63, *t.* 45 (1874). L. & J. Manual 170 (1884).

From the description and figures this species seems to be related to *O. alpestre* in its striate teeth, and to *O. strangulatum* Sull. in its slender fugacious cilia, and short seta immersed in the ochrea. The leaves are figured as papillose, and occasionally bistromatic.

In a recent letter Dr. Venturi says: "The specimens of *O. Hallii*, sent to me by M. Schrader, have the teeth erect when dry, and they are striolate. I regard it as belonging to the group of *O. anomalum*, and I have received it in the collection of M. Röhl, from Helena, Montana, in the Rocky Mountains, of which I send you a specimen. With *O. pumilum* it is certainly not related."

I have not seen the type, though it probably is at Cambridge, but plate 45 in the Icones Supplement, although it figures the teeth erect, shows them united in fours, with intermediate cilia, and the habitat is given as "on trees." I do not know who M. Schrader was, nor whether we have any reason to suppose that his specimens were authentic, but shall take the first opportunity of examining the type of this species and determining its relation. The specimens sent to me by Dr. Venturi from Röhl's collection are without calyptra; the two capsules are still immature, with the lids on, and do not show any very definite characters except the immersed stomata and partly exserted cylindric capsules.

Type locality: "On trees, Rocky Mountains of Colorado, E. Hall." Also collected at Helena, Montana, by Röhl, No. 1375.

At Kew, in Schimper's herbarium, there is a specimen labelled *O. Hallii* with also a manuscript name of Schimper's (*O. leptocarpum*, Sch. m. s.), collected by Drummond, locality not stated; but these specimens have no cilia, and the teeth are papillose, not striate. Macoun has recently sent us specimens labelled *O. Hallii* (fide Kindberg), which proved to be *O. strangulatum* Sull.

39. ORTHOTRICHUM OHIOENSE S. & L. (Sull. Icon. Supp. 66, t. 48 (1874).

This species is very common in the Eastern States, growing on trees mixed with *O. strangulatum*, Sull., ranging from Georgia and South Carolina, north to Ontario, west to the foot of the Rocky Mountains, in Montana, Röhl, No. 1267, recently reported by Venturi. (Hedwigia 32: 284, 1893).

#### VII. GROUP OF *O. TENELLUM*.

In this group are included two European species, *O. tenellum* and *O. Rogeri*, and four American, *O. cylindricarpum*, *O. Coulteri*, *O. Hendersoni*, and *O. Jamesianum*, the latter being anomalous on account of having no cilia.

40. ORTHOTRICHUM TENELLUM Bruch.

This species is characterized by its faintly papillose leaves, broad blunt points, upper half of the capsule exserted, neck immersed and tapering into a short seta, teeth united in pairs, papillose, cilia 8, calyptra sparsely hairy.

Type European; common in Central Europe on trees. Has also been reported from trees at the base of the Rocky Mountains, collected by Wolf & Rothrock and E. Hall.

41. ORTHOTRICHUM ROGERI Brid.

Differs from *O. tenellum* in its red teeth, shorter naked calyptra, shorter capsule, and leaves occasionally serrulate at apex.

Type European; on trees in the the mountains of Norway, Bohemia, Switzerland and the Tyrol. Not common and resembling *O. pallens*, according to Venturi. This species has been determined from specimens in our herbarium collected by J. B. Leiberger, on trunks of *Tsuga Pattoniana* in the Traill River Valley, Idaho, No. 233 (1890).

42. ORTHOTRICHUM CYLINDRICARPUM Lesq. Trans. Am. Phil. Soc. 13: 6 (1863). Proc. Cal. Acad. Sci. 1: 17 (1868). Sull. Icon. Suppl. 70, t. 52 (1874).

This species is said to be closely related to *O. tenellum*, differing in the shorter, less acuminate leaves, and the longer pedicel of the broader capsule.

Type locality, on rocks, Dardanelles Cañon, Bolander. Also on the bark of *Quercus agrifolia*, without locality, Bolander. Considering Sullivant's tendency to refer distinct American species to European ones, and the diversity of these habitats, these specimens need further examination. The latter was distributed as No. 178 of S. & L. Musci. Bor. Am. Ed. II. Also collected by Miss Martha R. Mann, "On live Oaks, at Monterey, Cal., February 12th, 1886," and by Marshall A. Howe, on trees at Berkeley, Cal., October, 1892.

43. *ORTHOTRICHUM COULTERI* Mitt. Journ. Linn. Soc. 8: 25 (1865).

This species is referred to *O. tenellum*, in the Manual. Mitten says of it: "Very similar in appearance to *O. tenellum*, Bruch, but its capsule exerted beyond the apices of the perichætil leaves, which are more acute, its calyptra more pilose, its cilia short, and its male flowers larger; *O. cylindricarpum* Lesq. is another closely allied Californian species."

Type locality, California, Coulter.

44. *ORTHOTRICHUM HENDERSONI* R. and C. Bot. Gaz. 15: 42, t. 7a (1890).

This species is allied to *O. stramineum* and *O. Rogeri*, differing from the first in the narrower, longer, flexuose leaves, twisted and slightly crispate when dry, the longer pedicel, the shorter hairs of the vaginule, the teeth are more elongated, darker yellow, split, not cribose-lacerate at apex; and from the last, in the twisted leaves, not excavate at base, and the capsule suddenly contracted below. On account of the crispate leaves, this moss has the facies of an *Ulota*.

Type locality: On bushes, Coast Mountains, Oregon, L. F. Henderson. We have been favored with a portion of the type. The specimens are old, the peristome gone, and the calyptra is unknown.

45. *ORTHOTRICHUM JAMESIANUM* Sull. U. S. Exp. Ex. 40th Par. 401 (1871); Sull. Icon. Musc. 71 t. 53 (1874); L. and J. Man. 177 (1884); Vent. Mus. Gall. 177 (1887); Macoun's Cat. part 6: 92 (1892).

This species is compared with *O. obtusifolium* in the Manual, which it resembles on account of its erect, appressed, blunt, papil-

lose leaves, with the vein ending below the apex; it differs, in having revolute margins and no propagulæ. In fact it belongs to the section with immersed stomata; has a shorter capsule and neck, is pyriform when fresh, urceolate when empty, has a simple peristome of 16 striolate teeth, reflexed in pairs when dry. It is not referable to any of the groups on account of having no cilia, though perhaps it is as closely allied to *O. tenellum* as any by its imbricate blunt leaves. Dr. Venturi is mistaken (l. c.) in stating that Lesquereux and James refer "*O. Jamesonianum*" to *O. rivulare*. We presume he has reference to this species though the spelling is different.

Type locality: On limestone rocks, East Humboldt Mountains, Nevada, Watson, altitude 7,000 feet; Fort St. James, British Columbia, Macoun. Also on rocks at Yale and Spence's Bridge, B. C., according to Macoun's Catalogue; but No. 129 of Canadian mosses, distributed as this species, is in our specimens all *O. obtusifolium*.

#### SUPPLEMENTARY NOTES ON THE NORTH AMERICAN SPECIES OF WEISSIA (ULOTA).

WEISSIA MEGALOSPORA (Vent.) E. G. Britton.

In the BULLETIN for February (21: 74-75, 1894), in comparing Kindberg's *Ulot subulifolia* and *subulata* with *U. megalospora* Vent., we stated that "we should not be surprised to find that these three species were one." We have since learned from Prof. Macoun, that the type localities of Kindberg's two species are the same, in fact he picked them both out of the same specimen, and Prof. Macoun thinks they are the same species. He has not been able to separate them in his herbarium.

Also in a recent letter from Dr. Venturi (March 6th, 1894) he says: "The two specimens which you send me (71, collected by W. N. Suksdorf, at Nooksack river, Washington, and No. 137, *U. subulifolia* Kindb. of Macoun's mosses, from New Westminster Junction, B. C.) are without doubt the same as my specimens of *U. megalospora*. The two specimens which you send do not attain quite the dimensions of the spores that I have seen in the specimens sent me by Dr. Dieck, but nevertheless I have found, partic-



ularly in No. 137, spores which reach a diameter of 40-41 micromillimeters. My type specimens attain 54-56 microm., but I see that there is great variety in the dimensions of the spores. I also see that the diagnostic value of the terminal cells of the leaves is purely relative, as in my type specimens the point is very much developed, whereas in your specimens it is shorter, and the upper leaves near the perichætium have not the prolongation into a uniserial set of cells. I find the cochleariform base of the leaves and the long defluent neck of the capsule, as well as its small size and pale color, more constant characters."

These observations agree with my own, only I should add that the tips of the leaves vary even on the same plant, those of the younger branches being more filiform pointed than the lower ones.

The species has now been collected in five localities. The type is from the Cascades of the Rigi, near Clear Lake, Washington, Röhl. It has also been collected at Weston, by Röhl, on *Alnus rubra*, Nooksack River, Whatcom county, Washington, by W. N. Suksdorf, 1890; on trunks of Hemlock (*Tsuga Pattoniana*) Traille River Valley, Idaho, No. 234, by J. B. Leiberger, besides Macoun's locality at New Westminster Junction, British Columbia.

### New Piperaceæ from Bolivia.

BY C. DE CANDOLLE.

PEPEROMIA R. & Pav.

P. PSEUDO-RUFESCENS, glabra foliis modice petiolatis rotundatae ovatis novemnerviis nervo centrali paulo supra basin alternotim nervum utrinque unum mittente lateralibus nervis fere medio bifurcatis, amentis oppositifolius modice pedunculatis ipsis florentibus quam folia brevioribus in sicco rufescentibus subdensifloris, bractea orbiculari fere centro peltata ovario emerso globoso-elliptico apice imo stigmatifero stigmate carnosum rotundatum puberulum.

In Bolivia prope Cochabamba (Bang n. 1148<sup>a</sup> in n. herb. Columb. Coll.)

Herba erecta? inferne radicans caule in sicco complanato coriaceo inferne 6 mm. crasso. Limbi in sicco membranacei